

**Abstract of the Disclosure**

A System and Method of Molecule Counting Using Fluctuation Enhanced Sensors includes processes for improved chemical analyte detection and quantification through the measurement and generation of an amplitude density histogram of the measured time series of frequency fluctuations in the instantaneous frequency of a chemical sensor arranged to produce an oscillatory output signal when exposed to chemical substances. The system and method may use a chemical sensor, such as a surface acoustic wave (SAW) device. Statistical analysis produces the amplitude density of the frequency fluctuations, which are represented as a pattern that includes information about the quantity of the analyte on the surface of the sensor. Patterns in the measured amplitude density are then correlated to theoretical amplitude density functions in order to determine the number of analyte molecules on the surface of the sensor.